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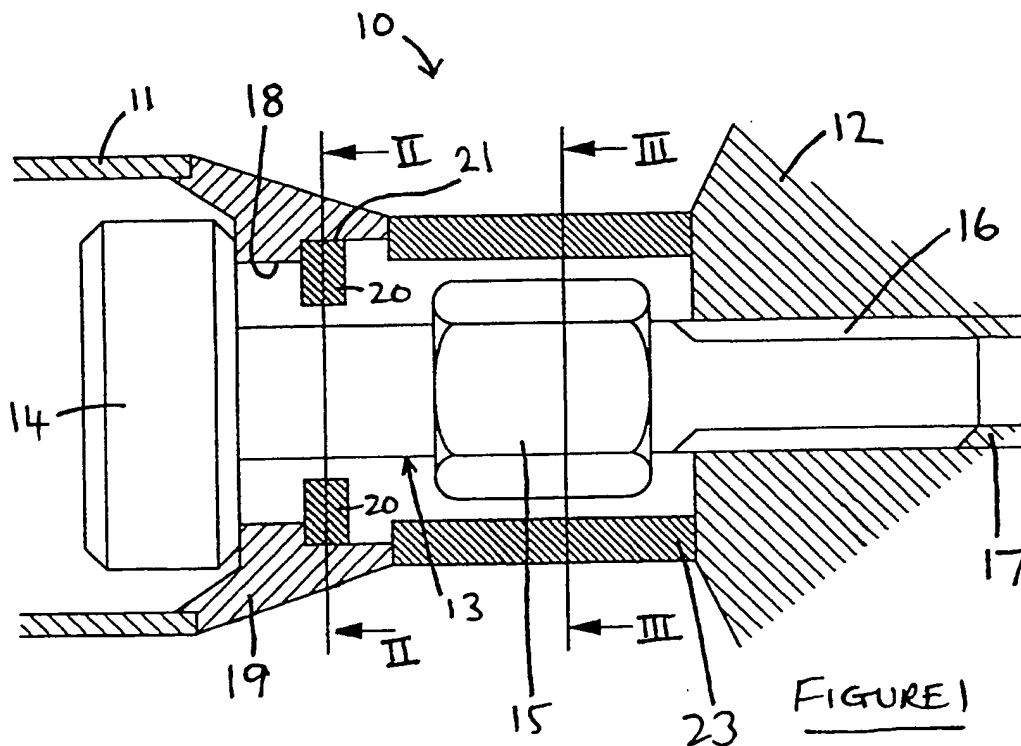
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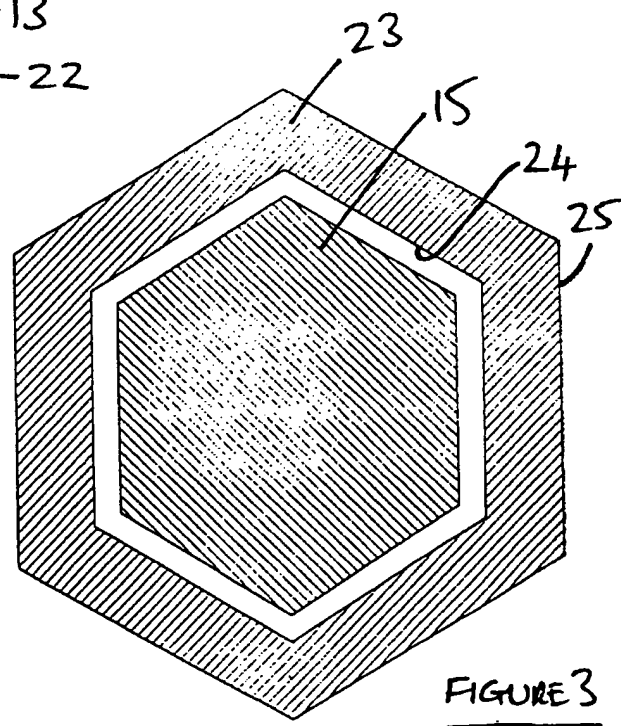
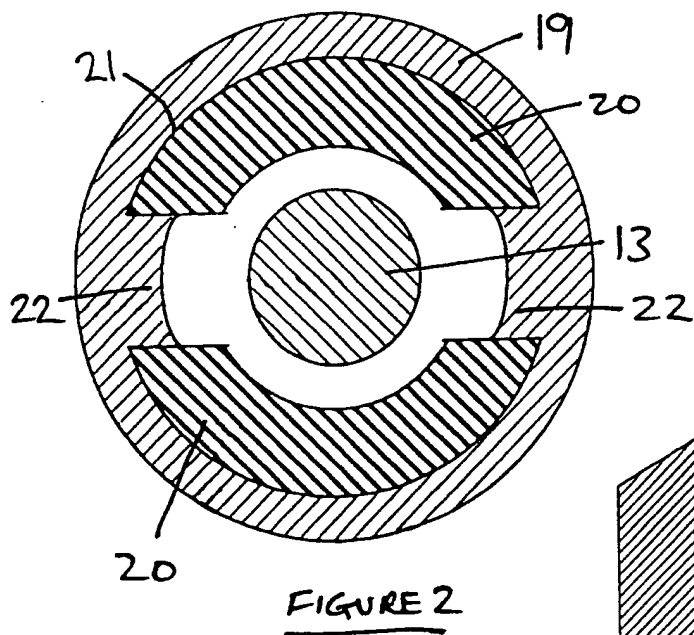
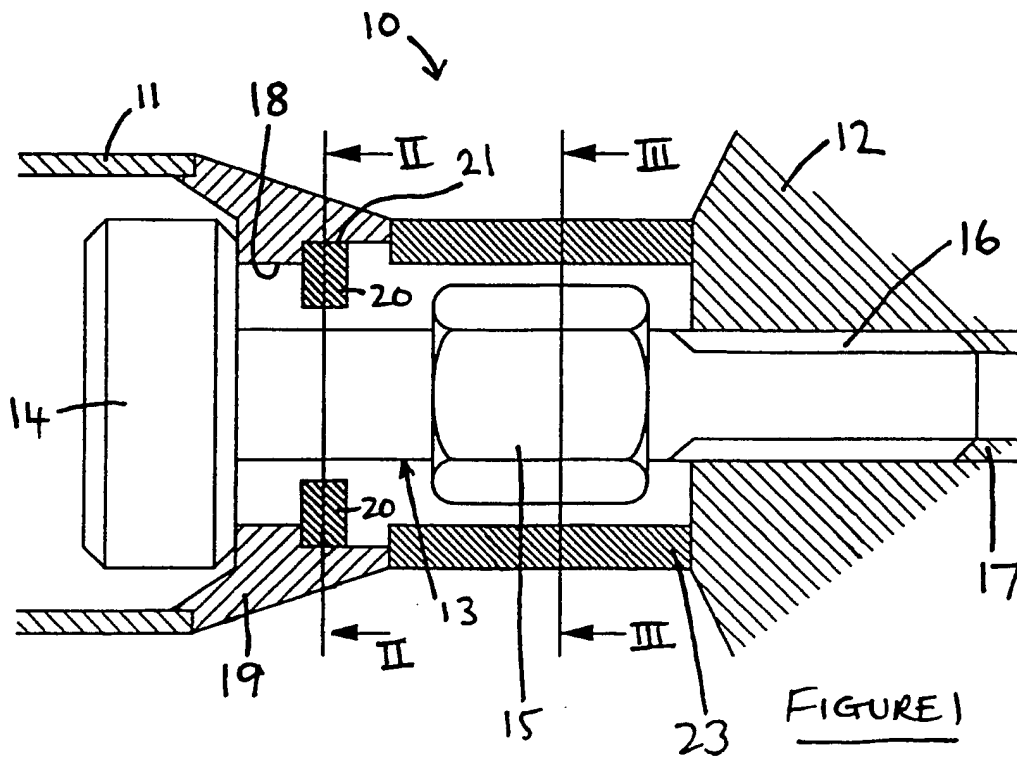
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(54) Frame joints

(57) An end cap 19 prevents the head 14 of a bolt 13 from passing through and split collars 20 limit movement of the bolt 13 in the other direction because they foul a raised hexagonal section portion 15. The end cap is secured to a tubular member 11 and a cooperating hexagonal sleeve 23 ensures rotation of the bolt so that the threaded portion 16 can be secured in a threaded hole 17 in block 12. The bolt 13 may be biased axially towards the block 12 by a spring.



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FRAME JOINTS

This invention relates to frame joints and more particularly to joints for what are sometimes known as space frames.

05 Space frame structures are widely used in the construction of roofs of buildings, particularly those of large span, for example sports stadia. One common choice of structural member for such applications is formed from a length of hollow metal tube having a terminating cap at each end. Connections between members is achieved by attaching the end caps to metal spheres
10 which constitute joint centres. The tightening of the joint depends on the particular nature of the apparatus but in some apparatus a sleeve surrounds the bolt so that torque applied to the sleeve is transferred directly to the bolt.

As the bolt forms an integral part of the joint it is important
15 that its strength is not unduly impaired by the manner in which the sleeve acts on it, so as to avoid additional reinforcement of the bolt. In large span applications it is important that structural self weight, including that of the joints, remains low and that efficient use is made of all structural material.

20 According to the present invention there is provided connection means for joining a member to a connecting block, the connection means comprising an end cap for attachment to said member which end cap has an aperture through which extends a bolt having a head at one end which head cannot pass through said aperture, a

raised portion which is spaced from said head and which is polygonal in cross-section, and a threaded portion between the raised portion and the other end, a sleeve having an inner surface which is polygonal in section for cooperation with said
05 polygonal raised portion and an outer surface which in section is in the form of another polygon, and means being positionable between the head and said raised portion, to prevent the raised portion from returning through the aperture.

Preferably said means comprises two or more split collars which
10 are locatable in a recess in the end cap adjacent said aperture so as to narrow said aperture. Conveniently the split collars are secured in place using an adhesive and two split collars are provided.

In a preferred arrangement biasing means is disposed between
15 the split collars and the raised portion of the bolt to urge the head of the bolt into abutment with the end cap, and more preferably the biasing means comprises a compression spring.

Embodiments of the invention will now be described in more detail. The description makes reference to the accompanying
20 drawings in which:

Figure 1 is a lengthwise section through a joint according to the present invention,

Figure 2 is a section on line II-II of figure 1,

Figure 3 is a section on line III-III of figure 1, and

Figure 4 is a lengthwise section through a second embodiment of joint according to the present invention.

Figure 1 shows a structural joint 10 for joining a tubular member 11 to a nodal connecting block 12. A bolt 13 has a head 14, a hexagonal shaft portion 15 and a threaded portion 16 for
05 engagement in a threaded hole 17 in block 12.

The threaded portion 16 and hexagonal portion 15 of the shaft of the bolt 13 are passed through a hole 18 in an end cap 19 but the head 14 is too large to pass through. Two split collars 20
10 are then fixed into a cylindrical recess 21 in the end cap. The fixing of the split collars 20 is preferably by adhesive but may be by other suitable means. For example, in figure 2 the recess 21 is provided with shoulders 22 for retaining the split collars 20. The end cap 19 is then secured, for example by
15 welding, to the end of the tubular member 11. It will of course be appreciated that these components are dimensioned so that the head 14 of the bolt cannot pass through the hole 18 in the end cap 19 and the hexagonal shaft portion 15 cannot pass the split collars 20. The bolt 13 is therefore capable of only limited
20 axial movement relative to the tubular member 11 and the end cap although rotation of the bolt about the lengthwise axis is unhindered. The bolt 13 cannot now fall back into the tubular member 11.

A sleeve 23 is then placed over the hexagonal shaft portion 15
25 of the bolt 13. The sleeve 23 has an internal surface 24 which

is hexagonal in section for engagement with the hexagonal shaft portion 15 of the bolt and an external surface 25 which is also hexagonal in section to facilitate rotation using a spanner or like tool. Rotation of the sleeve 23 clearly causes the bolt 13 to rotate.

In use therefore the threaded end 16 of the bolt is inserted into the hole 17 in the block 12 and the sleeve is rotated until the tubular member is securely connected to the block 12. The neat connection shown in figure 1 is thereby attained.

Reversal of the procedures mentioned above enables the joint to be dismantled.

It will of course be appreciated that many similar joints between tubular members are necessary to produce a framework but it is not necessary to describe the construction further.

In other arrangements of course the hexagonal sections may be replaced by any suitable polygonal sections and indeed the surfaces 24 and 25 may be different types of polygon to each other.

The embodiment shown in figure 4 is the same in most ways as the embodiment in figures 1 to 3 and so like parts have been designated by like reference numerals. The figure 4 arrangement differs however in that a spring 30 is disposed between the hexagonal portion 15 of the bolt 13 and the split collars 20.

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This arrangement has the advantage of keeping the head 14 of the bolt 13 urged against the surrounds of the hole 18 in the endcap 19 so that the bolt projects as fully as possible from the end cap 19.

CLAIMS

1. Connection means for joining a member to a connecting
block, the connection means comprising an end cap for
attachment to said member which end cap has an aperture
05 through which extends a bolt having a head at one end which
head cannot pass through said aperture, a raised portion
which is spaced from said head and which is polygonal in
cross-section, and a threaded portion between the raised
portion and the other end, a sleeve having an inner surface
10 which is polygonal in section for cooperation with said
polygonal raised portion and an outer surface which in
section is in the form of another polygon, and means being
positionable between the head and said raised portion, to
prevent the raised portion from returning through the
15 aperture.
2. Means as claimed in Claim 1 wherein said means comprises
two or more split collars which are locatable in a recess
in the end cap adjacent said aperture so as to narrow said
aperture.
- 20 3. Means as claimed in Claim 2 wherein biasing means is
disposed between the split collars and the raised portion
of the bolt to urge the head of the bolt into abutment with
the end cap.

4. Means as claimed in Claim 3 wherein the biasing means comprises a compression spring.
5. Means as claimed in any one of Claims 2 to 4 wherein the split collars are secured in place using an adhesive.
- 05 6. Means as claimed in any one of Claims 2 to 5 wherein two split collars are provided.
7. Means as claimed in any one of Claims 1 to 6 wherein the raised portion is hexagonal in section and the inner surface of the sleeve is hexagonal in section.
- 10 8. Connection means substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.